



# Pulse-Start

SuperCWA, Linear Reactor and Regulated Lag Ballasts

For Pulse-Start Metal Halide Lamps



high intensity discharge



# The New G

of high performance

## The HID dilemma...Good yellow light or poor white light

Until now, high intensity discharge (HID) lighting involved an unavoidable compromise. High pressure sodium (HPS) systems are energy efficient and cost effective but produce hazy yellow illumination. While metal halide lighting delivers white light, it does so at the cost of operational inefficiencies.

## Advance leadership powers the solution

New pulse-start metal halide ballast/lamp systems resolve the yellow light/white light compromise for good. An unprecedented alliance between Advance and the top four U.S. lamp manufacturers has spurred the joint re-engineering of traditional metal halide lamp and ballast technology.

## Cooperative lamp and ballast development delivers an optimized system

The results of this unique cooperative effort are new and inter-related lamp and ballast designs that dramatically improve virtually every aspect of metal halide

lighting, including enhanced lumens per watt and lumen maintenance, longer lamp life and superior color stability.

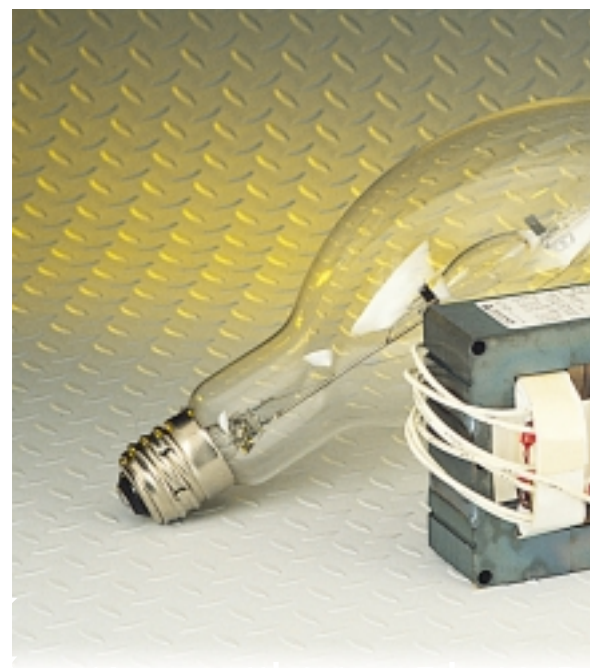
## HID lamp development

Both high pressure sodium and metal halide lamps were developed in the 1960s as design improvements over the earlier mercury vapor lamps. Like mercury vapor lamps, traditional probe-start metal halide

## Exclusively from Advance

A full pulse-start metal halide ballast product line for superior quality and cost-efficient lighting:

- Super Constant Wattage Auto-transformer (SuperCWA) Ballast  
Mainstream applications from 150w to 1000w, 60hz and 50hz
- Linear Reactor Ballast  
Significant energy savings and superior lumen maintenance for 277v applications
- Regulated Lag Ballast  
Premium performance for long life with high lumen maintenance and color stability. Ideal for applications with long burning hours and/or costly lamp maintenance



# eneration

## metal halide ballast/lamp systems



lamps have an internal starting electrode, or probe, powered by a high open circuit voltage from the ballast to initiate an arc. The ballast starts the lamp as well as regulates the current flowing through it. HPS also uses a ballast to regulate the current through the lamp, but includes an ignitor to send a high-voltage pulse directly across the operating electrodes to start the lamp. There is no starting probe.



### High pressure sodium vs. metal halide

High pressure sodium systems provide greater light output, lumen maintenance, lamp life and efficacy (lumens per watt) than probe-start metal halide. The yellow light is suitable for applications where color quality is secondary to low operating and maintenance costs. For applications where color quality is important, metal halide lamps produce crisp white light.

However, probe-start metal halide lighting has several performance drawbacks—shorter life, color variation between lamps, a shift in color of individual lamps over time, low efficacy and poor lumen maintenance.

### Pulse-Start System Applications

- *Supermarkets and other mass merchandising stores*
- *Production/assembly facilities*
- *Warehouses*
- *Retail outdoor lighting*
- *Building facade and atrium lighting*
- *Tunnels and roadways*
- *High ceiling public facilities*

HID LAMP COMPARISON

Feature	Mercury	Probe M.H.	H.P.S.
Color	White	White	Yellow
Efficacy (L/W)	50	60-85	100-125
Lumen Maint.	50%	65%	90%
Lamp Wattages	50-1000	175-1000	35-1000
Lamp Life (kHrs)	24+	6-20	24+

## Pulse-start metal halide lamps: a major innovation in HID lighting



### The challenge of improving probe-start metal halide lamps

Lamp manufacturers sought to improve probe-start metal halide lighting by changing the chemistry and increasing the fill pressure in the lamp arc tube to increase lumen efficacy (lumens per watt). However, probe-start lamps, with only a 600v peak starting voltage from the ballast, would not start where these improvements had been made.

### Advance ignitor clears the way for new lamp designs

The first step towards development of significantly improved metal halide lamps was Advance's introduction of an ignitor as a component of the ballast. The ignitor delivers a high voltage pulse directly across the lamp's operating electrodes to start the lamp, replacing the ballast's 600v peak voltage and eliminating the lamp's internal starting probe and its protective switch.

Incorporating an ignitor in the design of Advance pulse-start ballasts overcame the major barrier to re-engineering probe-start lamps. Lamp manufacturers could now utilize new arc tube designs and materials, allowing for higher operating pressures and new chemical fills.

### Ballast performance gains also realized

In addition to facilitating lamp improvements, Advance's ballast designs also optimized ballast performance. All pulse-start ballasts have been designed

to specifically meet the needs of the pulse-start lamps, and are not simply probe-start ballasts with added ignitors. The results are greater energy savings and improvements in lamp current crest factor and ballast life.

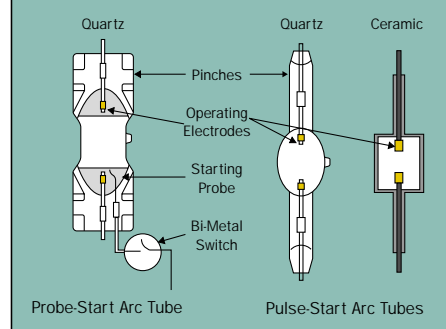
### Operational efficiencies approach high pressure sodium, plus white light

These inter-related ballast/lamp design innovations optimized pulse-start metal halide systems to provide virtually all the efficiencies of high pressure sodium—superior light output, high lumen maintenance and long life—plus white light.

COMPARISON WITH PULSE-START METAL HALIDE

Feature	Probe M.H.	Pulse M.H.	H.P.S.
Color	White	Whiter	Yellow
Efficacy (L/W)	60-85	90-110	100-125
Lumen Maint.	65%	80%	90%
Lamps	175-1000	35-750	35-1000
Lamp Life (kHrs)	6-16	10-30	24+

ARC TUBE CONSTRUCTION





# Exclusive Advance ballast designs: optimizing pulse-start system performance

## Separation of ballast functions optimizes performance

Replacing the internal starting probe with an ignitor allowed a separation of ballast starting and operating functions. The ignitor starts the lamp, and the ballast's core & coil operates the lamp, allowing for optimization of both lamp and ballast performance.

## Lower crest factor improves lamp life and lumen maintenance

The traditional lead-peak metal halide ballast, with its 600v peak open circuit voltage needed to start probe-start metal halide lamps, creates a high lamp current crest factor that compromises lamp performance. By focusing ballast design solely on lamp operation, Advance was able to lower the lamp current crest factor, resulting in improved lamp life, lumen maintenance and color stability.

Joint life tests with major lamp manufacturers reveal that pulse-start lamps operated by Advance pulse-start ballasts have a 10% better lumen maintenance factor than the same lamps operated by traditional lead-peak metal halide ballasts which have been modified to include the addition of an ignitor.

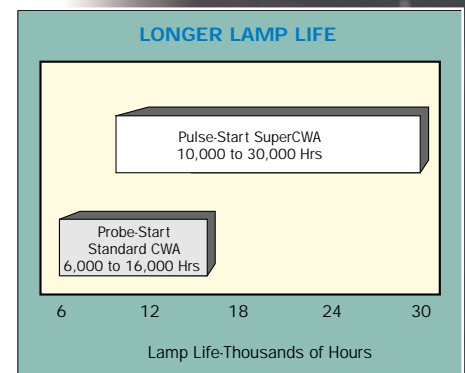
## Cooler operation for longer ballast life

By isolating lamp starting and operating functions, ballast operation is also made more efficient and cooler, because the ballast's core & coil no longer needs to supply the 600v starting voltage of probe-start metal halide ballasts. The ballast open circuit voltage requirement is now reduced to the operating requirements of the lamp.

This lower open circuit voltage creates lower ballast operating temperatures, resulting in longer ballast life, reduced maintenance/replacement costs, and the possibility of higher fixture ambient temperature ratings.

## Fits existing fixtures for ease of installation

Two of Advance's three new pulse-start ballast families have the same core dimensions as standard probe-start metal halide. Hence, they can fit into existing fixtures. Because the ballasts run cooler, they fit existing fixtures thermally as well; there is no risk of overheating.



# Pulse-start ballast/lamp systems: the new level of efficiency and performance

## Improved light output and lower operating costs

Optimized pulse-start ballast/lamp systems boost both lamp life and lumen output by 25% to 50%. Improving the quality and quantity of white light throughout lamp life provides substantial energy savings, since lower wattage pulse-start lamps produce the same light output as higher wattage probe-start lamps.

## Superior lumen maintenance assures consistent light levels

By achieving lumen maintenance of up to 80%, pulse-start lamps reduce light loss over life by up to one-third compared to probe-start metal halide. Fewer watts per square foot are required because consistently higher light levels are assured throughout lamp life.

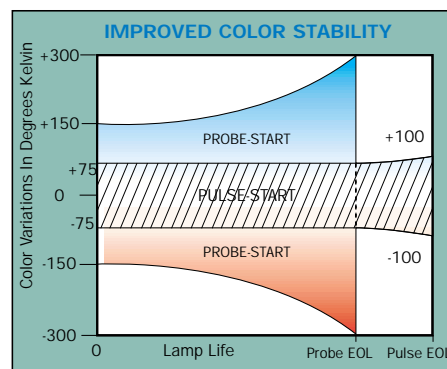
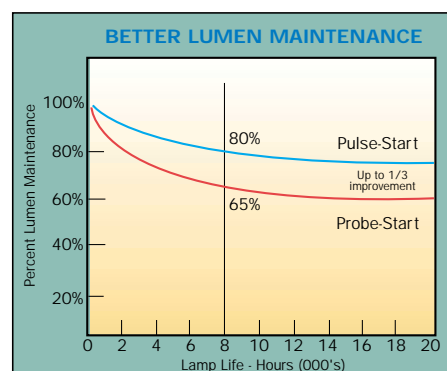
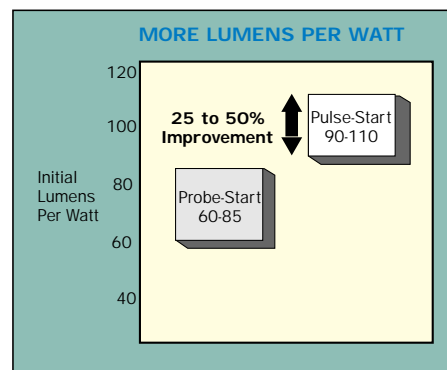
Increased lumens per watt and higher lumen maintenance translate into energy savings because a space can be lighted with either fewer fixtures or lower wattage fixtures with no diminishment of light quality.

## New levels of color stability

The improved crest factor and superior lamp wattage regulation provided by the exclusive new ballast designs from Advance, combined with the lamp's new arc tube chemistry and shape, deliver breakthrough improvements in pulse-start metal halide's color stability. Color stability is measured by a change in color temperature over the life of the lamp.

Wide operating temperature differences within probe-start arc tubes cause color shift and lumen loss as various chemicals leave the arc stream and deposit on the cooler parts of the arc tube walls. As lumen output and color rendering are affected by the mix of metal halides in the arc stream, loss of these chemicals impacts lamp performance.

The regulation and improved crest factor characteristics made possible by Advance's new pulse-start ballasts, coupled with the new arc tube shapes and chemical fills, assure optimum, consistent performance of the pulse-start lamps.



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### Less down time with faster warm-up and restrike

The addition of the external ignitor allows changes in the chemical fill to cut lamp warm-up time in half. Reducing warm-up time minimizes electrode wear, thus improving lamp life and lumen maintenance.

Reduced restrike time, the time required to restart lamps after power has been momentarily interrupted, drops to three to four minutes. This is 80% faster than probe-start.

### Colder starting

The high voltage ignitor pulse provides colder starting, to  $-40^{\circ}\text{F}/^{\circ}\text{C}$ , compared to  $-20^{\circ}\text{F}/-30^{\circ}\text{C}$  for probe-start technology.

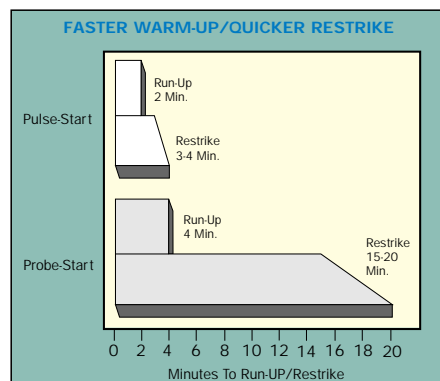
### An Advance pulse-start ballast for every HID application

Pulse-start ballast/lamp systems are the first major innovation in HID lighting in

30 years, delivering unprecedented savings in energy, operational and maintenance costs. Advance has been the only ballast manufacturer to work with all the major lamp companies to capitalize on the optimized design synergies of joint ballast/lamp system development. These unique partnerships continue and will further expand and improve pulse-start technology in the future.

The result is a new, dedicated pulse-start ballast line—the SuperCWA, Linear Reactor and Regulated Lag ballasts—which represents a new opportunity to upgrade both probe-start metal halide and high pressure sodium lighting.

The following pages detail the three different ballast circuits in the exclusive Advance pulse-start product line, providing an energy-saving, long life, white-light solution to virtually every HID application.



Pulse-start lamp/ballast systems compared to conventional metal halide ballasts

- **Greater efficacy**  
*Lumen output per watt consumed increases by 25% to 50%, depending on lamp wattage and burning cycle*
- **Better lumen maintenance**  
*Lumen maintenance up to 80% achieved - a 31% improvement*
- **Longer lamp life**  
*Life ratings of 20-30kHrs represent up to a 50% improvement*
- **Superior color rendition**  
*CRI of up to 85 represents a 30% improvement*
- **Reduced color shift**  
*Compared to probe-start metal halide, the change in color temperature over life is reduced by up to two-thirds*
- **Improved lamp-to-lamp color consistency**  
*A result of superior ballast regulation capabilities*
- **Faster warm-up**  
*Warm up time is cut in half to 2 minutes*
- **Quicker restrike**  
*Reduces the time needed to restart hot lamps after a momentary outage to 3 to 4 minutes*
- **Colder start**  
*To  $-40^{\circ}\text{F}/^{\circ}\text{C}$  versus  $-20^{\circ}\text{F}/-30^{\circ}\text{C}$*



## Three unique Advance ballast circuits meet every pulse-start application

As the only ballast manufacturer to partner with lamp companies on pulse-start system design, Advance Transformer offers the only full product line of pulse-start ballasts, with complete availability for general and specialized applications.

### SuperCWA

#### The mainstream workhorse

Exclusively from Advance, the SuperCWA ballast is the mainstay pulse-start ballast circuit for the typical HID application. It employs two coils to perform the needed voltage transformation to provide the right voltage to the lamp. In addition, the ballast and its associated capacitor work together to control the lamp current to the lamp manufacturers' specifications.

#### New, higher sustaining characteristics

Working with lamp manufacturers as they continue their development of pulse-start lamps, Advance engineers

have upgraded Super CWA ballast designs to incorporate higher "sustaining characteristics," providing for improved lamp starting, lumen maintenance, and longer lamp life.

Advance's SuperCWA ballasts are very cost effective. They have good regulation and voltage dip withstand characteristics to meet the needs of virtually every application. A reduced open circuit voltage resulting in a lower 1.6 crest factor also works to extend lamp life and lumen maintenance. The ballasts have lower losses, run cooler, and allow the use of Advance's 100°C dry-film capacitors for simplified fixture design and assembly.

SUPERCWA CASE STUDY: GAS STATION RETROFIT		
	400 CWA	320 SuperCWA
System Watts Per Fixture	458 Watts	368 Watts
Mean Lumens	28,800	26,400
Fixtures	20	20
Power Cost Per Fixt. Per Yr. @ 8¢ (4000 Hrs)	\$146.00	\$117.00
Total savings = \$29.00 x 20 = \$580 per year, forever!		

#### Applications

- 150 to 1000 watt
- Industrial, commercial and retail facilities
- Gas station canopies
- Outdoor area lighting, parking lots
- High mast lighting
- Roadways, replacing high pressure sodium

SuperCWA		
Features	Advantages	Benefits
Higher sustaining voltage	Improves starting Improves lumen maintenance	Assures lamps will light under marginal conditions Fewer fixtures required; more constant light levels throughout lamp life
Lower crest factor (1.6 vs. up to 1.8)	Extends lamp life Improves lumen maintenance	Longer time between lamp changes; reduces maintenance costs Extends useful lamp life
Lower ballast losses (5-10 watts less)	Ballast core & coil runs 5-8°C cooler	Ballast and other fixture electrical components last 50% longer Possible opportunity for higher ambient rating on fixture
Same size as existing probe-start CWA ballasts	Ballasts will fit into existing fixture designs Provides possibility of economical retrofit	Assures retrofit will "fit" thermally (not overheat) Fixture manufacturers can go to market immediately New business opportunity—over 70 million 400w MH & HPS fixtures in field today
100°C dry capacitor	Small size No exposed live parts 100°C temperature rating vs. 90°C for oil filled	Assures replacement will fit Simplifies fixture design and retrofit Assures quality



# Linear Reactor

## Energy-Savings opportunity for 277v applications

Only from Advance, the Linear Reactor ballast provides an additional 35 watts of energy savings for 277 volt applications. Coupled with lower wattage lamps of equal lumens for a typical 4000-5000 hour/year application, savings can total \$30-\$50 per fixture per year.

Because it is a single coil lag ballast, it does not change the sinusoidal wave shape of the incoming voltage. This results in a low 1.4 lamp current crest factor—ideal for arc discharge lamps and key to improving lumen maintenance and extending lamp life.

The Linear Reactor ballast is specifically designed to minimize the current draw of the ballast under lamp starting and open circuit conditions. As a result, Linear Reactors permit the same number of fixtures per circuit as CWA circuits.

This ballast also includes an integral ignitor for lamp starting. By incorporating the ignitor components within the coil wrappings, fixture design and assembly are simplified as one component replaces two.

An Advance dry-film capacitor is used for power factor correction. Dry-film capacitors enhance design flexibility through their reduced size and higher 100°C case temperature rating. They are easy to install, have no exposed live parts and provide long life reliability.



LINEAR REACTOR CASE STUDIES				
Grocery Store – Retrofit Choices				
	400 Watt Probe-Start (universal)	320 Watt Pulse-Start (base-up)	400 Watt Probe-Start (base-up)	350 Watt Pulse-Start (base-up)
Mean Lumens	25,000	25,000	28,000	31,500
Ballast Circuit	CWA	Linear Reactor	CWA	Linear Reactor
System Watts Per Fixture	460	342	460	375
Fixtures	400	400	400	400
Power Cost Per Fxt. Per Yr. @ 8¢ (5200 Hrs)	\$191.00	\$142.00	\$191.00	\$156.00
Total Store Savings	\$49.00 X 400 = \$19,600 per year, every year		\$35.00 X 400 = \$14,000 per year, every year	
Choices	320 watt pulse-start provides equal light output and cuts power costs by 25%		350 watt pulse-start provides 12 1/2% more light than premium base-up probe-start and still cuts power costs by 18%	

Grocery Store – New Construction Alternatives				
	400 Watt Probe-Start (universal)	400 Watt Probe-Start (base-up)	320 Watt Pulse-Start (base-up)	350 Watt Pulse-Start (base-up)
Mean Lumens	25,000	28,000	25,000	31,500
Fixture Lumens Adjustment Factor	1.00	.89	1.00	.79
Fixtures Required for Equal Lumens	400	356	400	296
Ballast Circuit	CWA	CWA	Linear Reactor	Linear Reactor
System Watts per Fixture	460	460	342	375
Total Store Watts	184,000	163,800	136,800	118,500
Annual Power Costs @ 8¢ (5200hrs)	\$76,500	\$68,140	\$56,660	\$ 46,200
Annual Savings vs. 400 Watt Probe (universal)		\$8,360 (11%)	\$19,840 (26%)	\$30,300 (39%)

### Applications

150 to 450 watt, 277v applications, where energy savings is desired

- Light industry
- Warehouses
- Supermarkets
- Large retail stores
- Parking garages

Linear Reactor		
Features	Advantages	Benefits
Designed specifically for 277 volt applications	No voltage transformation necessary	Low ballast losses, saves energy
Lowest crest factor (1.4)	Extends lamp life Improves lumen maintenance	Reduced maintenance costs Fewer fixtures required
100°C dry capacitor	Small size No exposed live parts  100°C temperature rating vs. 90°C for oil filled	Assures replacement will fit Simplifies fixture design, assembly and retrofit Assures quality
Integral ignitor	One component system	Simplifies fixture design, assembly and retrofit
Same size as existing CWA	Fits in existing fixture designs	OEMs can go to market quickly Opportunity for easy retrofits

# Regulated Lag

Premium performance to meet the needs of heavy industry

The Regulated Lag ballast design (also known as mag reg) is the premium ballast circuit of the Advance Transformer pulse-start line. Its low 1.5 lamp current crest factor and excellent 10:4 lamp wattage regulation (10% change in line voltage results in only a 4% change in lamp wattage) combine to significantly extend lamp life with improved lumen maintenance and color stability. Feedback from the field includes reports of applications with a working lamp life of 40,000 hours—virtually five years of 24 hour, 7 day per week continuous burn.

The superior lamp wattage regulation property yields two additional benefits particularly important for heavy industry applications. The Advance Regulated Lag ballasts will absorb system voltage dips of up to 50% as well as compensate for large voltage drops that can be associated with long circuit runs. These ballasts are also especially effective where voltage fluctuations are common due to the presence of large motors or other heavy loads on the electrical system.

REGULATED LAG CASE STUDY: HEAVY INDUSTRY			
	400W Probe	400W HPS	400W Pulse
Mean Lumens*	28,000	45,000	40,000
Fixture Required for Equal Lumens	1.6	1.0	1.1
Ballast Circuit	CWA	RegLag	RegLag
System Watts Per Fixture	460	490	470
Adjusted Fixture Watts	736	490	585
Annual Power Cost @ 8¢ (8760 Hrs)	\$515	\$343	\$410
400W pulse-start metal halide with RegLag ballasts is 20% more cost effective than 400W probe-start metal halide and only costs 17% more than high pressure sodium.			
*Note: Lamps are base-up designs. Rated lamp life of pulse-start metal halide and high pressure sodium lamps with RegLag ballasts are both 30,000 hours. Rated lamp life of probe-start metal halide with CWA ballasts is only 20,000 hours.			

## Applications

- 175 to 450 watt
- Heavy industry with large power fluctuations and long burning hour applications.
- Hard-to-reach installations or costly lamp changeout
- Roadways and tunnels
- Indoor high bay replacement

## Regulated Lag

Features	Advantages	Benefits
Low crest factor (1.5)	Extends lamp life to 40,000 hours Improves lumen maintenance	Reduced maintenance costs Fewer fixtures required
Premium regulation (10:4)	Maximizes lamp life 50% voltage dip withstand	Reduced maintenance costs Lamps stay lit
Above features in combination	Improves lamp-to-lamp color consistency and color stability	Better quality of light



# A full line of Advance pulse-start ballasts available

All ballasts listed are available from stock or regular production. For individual specification sheets, call Advance Transformer Co. at (847) 390-5000 or visit the product catalog section of our website: [www.advancetransformer.com](http://www.advancetransformer.com).

## SuperCWA Catalog Numbers

Lamp Watts ANSI Code	150W <sup>(1)</sup> M102/M142	175W M137	200W M136	250W M138	320W M132	350W M131	400W M135	450W M144	750W M149	1000W M141
120/208/240/277v 60Hz	—	71A5592	71A5692	71A5793	71A5892	71A5993	71A6092	71A6393	—	71A6593
120/277/347v 60Hz	71A54A3	71A55A2 <sup>(2)</sup>	71A56A2	71A57A3 <sup>(2)</sup>	71A58A2	71A59A3	71A60A2	71A63A3	—	—
480/120v out <sup>(3)</sup> 60Hz	(2)	(2)	71A5642-T	(2)	71A5842-T	71A5943-T	71A6042-T	71A6343-T	—	—
127/220v 60Hz	—	—	—	—	71A58H2	—	—	—	—	—
120/208/240v 60Hz	—	—	—	—	—	—	71A61E6 <sup>(4)</sup>	—	71A64E2	—
277/347/480v 60Hz	—	—	—	—	—	—	—	—	71A64F2	—
347/480/120v out <sup>(3)</sup> 60Hz	—	—	—	—	—	—	—	—	—	71A65F3-T
100/200v 60Hz	—	—	—	—	71A58Y2	—	—	—	—	—
100/200v 50Hz	—	—	—	—	71A58M2	—	—	—	—	—
120/220-240v 50Hz	—	—	—	—	71A58N2	71A59N3	71A60N2 <sup>(2)</sup>	—	—	—

(1) High reactance-high power factor (Hx-HPF) ballasts also available for 150W lamps; 71A5492 (120/208/240/277v 60Hz), 71A54A2 (120/277/347v 60Hz), 71A5482 (120/277v 60Hz).

(2) Consult factory for availability.

(3) Suffix-T indicates ballast includes 120 volt output for incandescent emergency lighting (quartz lamps).

(4) SuperCWI Constant Wattage Isolated ballast circuit.

▼ - NEW!

## 277 VOLT 60Hz LINEAR REACTOR

Lamp Watts ANSI Code	150W M102/M142	200W M136	250W M138	320W M132	350W M131	400W <sup>(6)</sup> M59	400W M135	450W M144
Catalog Number <sup>(5)</sup>		71A5637-B	71A5737-B	71A5837-B	71A5937-B	71A6037-B	71A6137-B	71A6337-B

(5) Suffix -B indicates ballast includes integral ignitor.

(6) Probe-start 400 watt metal halide lamp.

## REGULATED LAG Catalog Numbers

Lamp Watts ANSI Code	175W M137	200W M136	250W M138	400W M128/M135	450W M144
120v 60Hz	71A5504	—	71A5704	71A6004	—
208/240/120v out <sup>(3)</sup> 60Hz	—	—	71A5724-T <sup>(7)</sup>	71A60E4-T	—
277/120v out <sup>(3)</sup> 60Hz	71A5534-T	71A5634-T	71A5734-T	71A6034-T	71A6334-T
347/120v out <sup>(3)</sup> 60Hz	71A55B4-T	—	71A57B4-T	71A60B4-T	—
480/120v out <sup>(3)</sup> 60Hz	71A5544-T	—	71A5744-T	71A6044-T	—
230/120v out <sup>(3)</sup> 50Hz	—	—	—	71A60S4-T	—

(3) Suffix -T indicates ballast includes 120 volt output tap for incandescent emergency lighting (quartz lamps).

(7) 240/120v out only.



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